

1      WHAT IS CLAIMED IS:

1. An apparatus for obtaining local fluid properties along a fluid piping system comprising:
  - 5      a primary pipe comprising an inlet, an outlet, and at least one sidewall that defines a conduit for passing fluid from the inlet to the outlet;
  - a protective shield disposed with the conduit;
  - a scraper disposed about at least a portion of the protective shield for removing buildup on the protective shield, the scraper being longitudinally movable along the protective shield
  - 10     between a first position and a second position by an external force; and
  - a measurement device mounted within the protective shield between the first position and the second position.
2. An apparatus according to claim 1, wherein at least a portion of the scraper  
15    comprises a magnetic material.
3. An apparatus according to claim 2, wherein the apparatus further comprises at least one solenoid or permanent magnet installed outside the primary pipe, wherein the at least one solenoid or permanent magnet generates an external electromagnetic force for longitudinally moving the scraper.  
20
4. An apparatus according to claim 3, wherein the apparatus comprises two solenoids installed outside the primary pipe.
- 25     5. An apparatus according to claim 4, wherein the primary pipe has a circumference and each solenoid is mounted around the entire circumference of the primary pipe.
6. An apparatus according to claim 4, wherein the primary pipe has a circumference and each solenoid is mounted around a portion of the circumference of the primary pipe.  
30
- 35     7. An apparatus according to claim 2, wherein the primary pipe is generally tubular and the apparatus further comprises:
  - a first solenoid mounted circumferentially around at least a portion of the primary pipe and polarized with an S-N polarity; and

1           a second solenoid mounted circumferentially around at least a portion of the primary pipe next to the first solenoid and polarized with an N-S polarity;

5           whereby the solenoids create an electro-magnetic field that, when applied to the scraper, move the scraper longitudinally along the protective shield between the first position and the second position.

8.         An apparatus according to claim 7, wherein the scraper comprises:

a scraping element slidably disposed about at least a portion of the outer perimeter of the protective shield between the first and second positions; and

10          a magnetic core attached to the scraping element and positioned between the scraping element and the solenoids.

9.         An apparatus according to claim 8, wherein the magnetic core is generally tubular.

15          10.       An apparatus according to claim 8, wherein the scraping element is generally tubular and is disposed about the entire outer perimeter of the protective shield.

11.       An apparatus according to claim 10, wherein the magnetic core is generally cylindrical and is concentrically disposed about the scraping element.

20          12.       An apparatus according to claim 1, wherein the scraper comprises:  
a scraping element slidably disposed about at least a portion of the outer perimeter of the protective shield between the first and second positions; and  
a magnetic core attached to the scraping element and positioned between the scraping element and the sidewall of the primary pipe.

25          13.       An apparatus according to claim 12, wherein the magnetic core is generally tubular.

30          14.       An apparatus according to claim 12, wherein the scraping element is generally tubular and is disposed about the entire outer perimeter of the protective shield.

35          15.       An apparatus according to claim 14, wherein the magnetic core is generally cylindrical and is concentrically disposed about the scraping element.

1        16. An apparatus according to claim 1, wherein the primary pipe is generally tubular and the protective shield is mounted coaxially within the primary pipe.

5        17. An apparatus according to claim 1, wherein the primary pipe is generally tubular and the protective shield is mounted parallel to the axis of the primary pipe.

18. An apparatus according to claim 1, wherein the measurement device comprises a temperature sensor.

10       19. An apparatus according to claim 1, further comprising a second pipe that is perpendicular to the primary pipe, the second pipe having a closed end, an open end in communication with the conduit of the primary pipe, and at least one sidewall defining a secondary conduit between the closed and open ends; wherein the protective shield is disposed parallel to the axis of the secondary conduit so that an end of the protective shield is positioned within the primary conduit.

15       20. An apparatus according to claim 19, wherein at least a portion of the scraper is disposed within the secondary conduit.

20       21. An apparatus according to claim 19, wherein at least a portion of the scraper comprises a magnetic material.

25       22. An apparatus according to claim 19, wherein the apparatus further comprises at least one solenoid or permanent magnet installed outside the primary pipe, wherein the at least one solenoid or permanent magnet generates an external electromagnetic force for longitudinally moving the scraper.

23. An apparatus according to claim 22, wherein the apparatus comprises two solenoids installed outside the primary and secondary pipes.

30       24. An apparatus according to claim 23, wherein the scraper comprises:  
a scraping element slidably disposed about at least a portion of the outer perimeter of the protective shield between the first and second positions; and  
a magnetic core attached to the scraping element and positioned between the scraping element and the solenoids.

1        25. An apparatus according to claim 24, wherein the scraping element is generally tubular and is disposed about the entire outer perimeter of the protective shield.

5        26. A method for cleaning a portion of a protective shield containing a measuring device, the method comprising:

providing a scraper disposed about at least a portion of the protective shield;

applying an external force to the scraper to move the scraper longitudinally along the protective shield between first and second positions to thereby clean the portion of the protective shield over which the scraper moves.

10

27. A method according to claim 26, wherein the measurement device comprises a temperature sensor.

15        28. A method according to claim 26, wherein at least a portion of the scraper comprises a magnetic material, whereby the external force comprises an electromagnetic force.

29. A method according to claim 26, wherein the protective shield is disposed within a pipe.

20        30. A method according to claim 29, wherein the external force is generated by at least one solenoid or permanent magnet installed outside the pipe.

31. A method according to claim 29, wherein the external force is generated by two solenoids installed outside the pipe.

25

32. A method according to claim 31, wherein the pipe has a circumference and each solenoid is mounted around the entire circumference of the pipe.

30        33. A method according to claim 29, wherein the pipe is generally tubular and the apparatus further comprises:

a first solenoid mounted circumferentially around at least a portion of the pipe and polarized with an S-N polarity; and

a second solenoid mounted circumferentially around at least a portion of the pipe next to the first solenoid and polarized with an N-S polarity;

35

1 whereby the solenoids create an electromagnetic field that move the scraper longitudinally along the protective shield between the first position and the second position.

5       34. A method according to claim 33, wherein the scraper comprises:  
a scraping element slidably disposed about at least a portion of the outer perimeter of the protective shield between the first and second positions; and  
a magnetic core attached to the scraping element and positioned between the scraping element and the solenoids.

10      35. A method according to claim 34, wherein the scraping element is generally tubular and is disposed about the entire outer perimeter of the protective shield.

15      36. A method according to claim 35, wherein the magnetic core is generally cylindrical and is concentrically disposed about the scraping element.

15      37. An apparatus for obtaining local fluid properties along a fluid piping system comprising:  
a primary pipe comprising an inlet, an outlet, and at least one sidewall that defines a conduit for passing fluid from the inlet to the outlet;  
20      a generally-tubular protective shield disposed with the conduit and having an end that is mounted in a hole in the sidewall of the primary pipe;  
        a measurement device mounted within the protective shield;  
        a wire extending through the protective shield and having a first end connected to the measurement device and a second end outside the primary pipe.

25      38. An apparatus according to claim 37, wherein the measurement device comprises a temperature sensor.

30

35